

# Dell Storage Center

## SCv2000 and SCv2020 Storage System

### Getting Started Guide

Regulatory Model: E09J, E10J  
Regulatory Type: E09J001, E10J001



# Notes, Cautions, and Warnings

 **NOTE:** A NOTE indicates important information that helps you make better use of your computer.

 **CAUTION:** A CAUTION indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

 **WARNING:** A WARNING indicates a potential for property damage, personal injury, or death.

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# Before You Begin

Consider the following best practices before setting up your SCv2000/SCv2020 storage system.


- Dell recommends that you use a dedicated SAN network for data transmission when using a Fibre Channel or iSCSI storage system.
- Complete the *Worksheet to Record System Information* in this guide before configuring the storage system.
- Always configure redundant data paths to provide alternate paths to and from the host server should one of the data paths become disabled.
- Before connecting any cables between the storage system and host server or expansion enclosure, physically label each port and connector.
- Always follow proper power-up and power-down procedures when cycling power across the network. Verify that critical network components are on separate power circuits.


 **NOTE:** This product is intended for restricted access locations, such as a dedicated equipment room or equipment closet.

 **WARNING:** If installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient temperature. Therefore, consideration should be given to installing the equipment in an environment compatible with the maximum ambient temperature (T<sub>ma</sub>) specified by the manufacturer.

## Safety Warnings



 **CAUTION:** Remove the battery pack before removing a storage controller from the storage system.


 **WARNING:** Installing an incompatible battery may increase the risk of fire or explosion. Observe the following precautions:

- The battery should only be replaced with a battery that is the same or equivalent as the factory installed battery.
- Do not attempt to open or service the battery. Do not dispose of the battery in a fire or with household waste. Contact the local waste disposal agency for the location of the nearest battery deposit site.

### Laser Radiation for Fibre Channel Storage Systems



 **CAUTION:** Class I laser radiation when open, avoid exposure to beam.

 **WARNING:** Laser radiation, avoid direct exposure to beam.

The unit is certified in the U.S. to conform to the requirements of DHHS 21 CFR, chapter 1 Subchapter J for Class I (1) laser products, and elsewhere is certified as a Class I laser product conforming to the requirements of IEC 60825-1:2007.

Class I laser products are not considered to be hazardous. The laser system and unit are designed so there is never any human access to laser radiation above a Class I level during normal operation, user maintenance or prescribed service condition.

# Worksheet to Record System Information

Use the following worksheet to record the information that is needed to install the SCv2000/SCv2020 storage system.

## Storage Center Information

Gather and record the following information about the Storage Center network and the administrator user.

**Table 1. Storage Center Network**


Service Tag	_____
Management IPv4 address (Storage Center management address)	____ . ____ . ____ . ____
Top Controller IPv4 address (Controller 1 MGMT port)	____ . ____ . ____ . ____
Bottom Controller IPv4 address (Controller 2 MGMT port)	____ . ____ . ____ . ____
Subnet mask	____ . ____ . ____ . ____
Gateway IPv4 address	____ . ____ . ____ . ____
Domain name	_____
DNS server address	____ . ____ . ____ . ____
Secondary DNS server address	____ . ____ . ____ . ____

**Table 2. Storage Center Administrator**

Password for the default Storage Center "Admin" user	_____
Email address of the default Storage Center "Admin" user	_____

## iSCSI Fault Domain Information

For a storage system with iSCSI front-end ports, gather and record network information for the iSCSI fault domains. This information is needed to complete the **Discover and Configure Uninitialized SCv2000 Series Storage Centers** wizard.

 **NOTE:** For a storage system deployed with two Ethernet switches, Dell recommends setting up each fault domain on separate subnets.

See the *Dell Storage Center SCv2000/SCv2020 Storage System Deployment Guide* for information about setting up iSCSI fault domains.

**Table 3. iSCSI Fault Domain 1**

Target IPv4 address	____ . ____ . ____ . ____
Subnet mask	____ . ____ . ____ . ____
Gateway IPv4 address	____ . ____ . ____ . ____

IPv4 address for storage controller module 1: port 1	____ . ____ . ____ . ____
IPv4 address for storage controller module 2: port 1	____ . ____ . ____ . ____
(Four port I/O card only) IPv4 address for storage controller module 1: port 3	____ . ____ . ____ . ____
(Four port I/O card only) IPv4 address for storage controller module 2: port 3	____ . ____ . ____ . ____

**Table 4. iSCSI Fault Domain 2**

Target IPv4 address	____ . ____ . ____ . ____
Subnet mask	____ . ____ . ____ . ____
Gateway IPv4 address	____ . ____ . ____ . ____
IPv4 address for storage controller module 1: port 2	____ . ____ . ____ . ____
IPv4 address for storage controller module 2: port 2	____ . ____ . ____ . ____
(Four port I/O card only) IPv4 address for storage controller module 1: port 4	____ . ____ . ____ . ____
(Four port I/O card only) IPv4 address for storage controller module 2: port 4	____ . ____ . ____ . ____

## Additional Storage Center Information

The Network Time Protocol (NTP) and Simple Mail Transfer Protocol (SMTP) server information is optional. The proxy server information is also optional, but it may be required to complete the **Discover and Configure Uninitialized SCv2000 Series Storage Centers** wizard.

**Table 5. NTP, SMTP, and Proxy Servers**

NTP server IPv4 address	____ . ____ . ____ . ____
SMTP server IPv4 address	____ . ____ . ____ . ____
Backup SMTP server IPv4 address	____ . ____ . ____ . ____
SMTP server login ID	_____
SMTP server password	_____
Proxy server IPv4 address	____ . ____ . ____ . ____

## Fibre Channel Zoning Information

For a storage system with Fibre Channel front-end ports, record the physical and virtual WWNs of the Fibre Channel ports in Fault Domain 1 and Fault Domain 2. This information is displayed on the **Review Front-End** page of the **Discover and Configure Uninitialized SCv2000 Series Storage Centers** wizard. Use this information to configure zoning on each Fibre Channel switch.

See the *Dell Storage Center SCv2000/SCv2020 Storage System Deployment Guide* for information about setting up Fibre Channel zoning.

**Table 6. Physical WWNs in Fault Domain 1**

Physical WWN of storage controller 1: port 1	_____
Physical WWN of storage controller 2: port 1	_____
(Four port I/O card only) Physical WWN of storage controller 1: port 3	_____
(Four port I/O card only) Physical WWN of storage controller 2: port 3	_____

**Table 7. Virtual WWNs in Fault Domain 1**

Virtual WWN of storage controller 1: port 1	_____
Virtual WWN of storage controller 2: port 1	_____
(Four port I/O card only) Virtual WWN of storage controller 1: port 3	_____
(Four port I/O card only) Virtual WWN of storage controller 2: port 3	_____

**Table 8. Physical WWNs in Fault Domain 2**

Physical WWN of storage controller 1: port 2	_____
Physical WWN of storage controller 2: port 2	_____
(Four port I/O card only) Physical WWN of storage controller 1: port 4	_____
(Four port I/O card only) Physical WWN of storage controller 2: port 4	_____

**Table 9. Virtual WWNs in Fault Domain 2**

Virtual WWN of storage controller 1: port 2	_____
Virtual WWN of storage controller 2: port 2	_____
(Four port I/O card only) Virtual WWN of storage controller 1: port 4	_____
(Four port I/O card only) Virtual WWN of storage controller 2: port 4	_____


## Locating Your Service Tag

Your storage system is identified by a unique Service Tag number.

You can find the Service Tag number on the service luggage tag located next to the front panel display. The Service Tag number is also located on the back of the storage system chassis. Dell uses this information to route support calls to the appropriate personnel.

## Other Information You May Need

Additional information you may need to install the storage system.

 **NOTE:** See the safety and regulatory information that shipped with your Storage Center components. Warranty information is included as a separate document.

- The *Dell Storage Center SCv2000/SCv2020 Storage System Deployment Guide* provides information about cabling Storage Center hardware components and configuring a new Storage Center using the Dell Storage Client.

- The *Dell Storage Center Dell Storage Client Administrator's Guide* describes how to use the Dell Storage Client to manage a Storage Center.

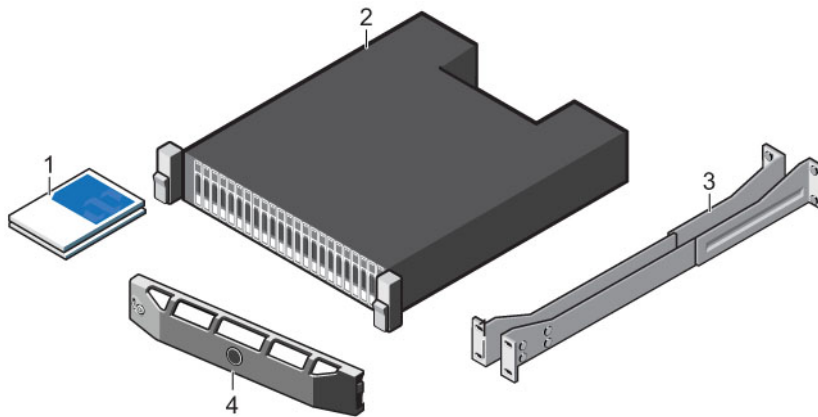
## Installation and Configuration

Before you begin installation, make sure that the site where you plan to install the storage system has standard power from an independent source or a rack power distribution unit with a UPS.

In addition, verify that there is space in the rack to install the storage system.

### Unpacking Storage Center Equipment

Unpack the storage system and identify the items in your shipment.



**Figure 1. SCv2000/SCv2020 Storage System Components**

- |                  |                   |
|------------------|-------------------|
| 1. Documentation | 2. Storage system |
| 3. Rack rails    | 4. Front bezel    |

### Installing the Storage System in a Rack

Install the SCv2000/SCv2020 storage system and other Storage Center system components in a rack.

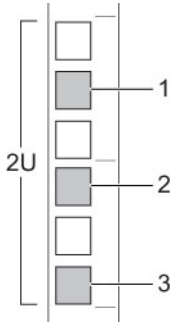
**NOTE:** Mount the storage system in a manner that allows for expansion in the rack and prevents the rack from becoming top-heavy.

1. Secure the rails that are pre-attached to both sides of the storage system chassis.
  - a. Lift the locking tab on the rail.
  - b. Push the rail towards the back of the chassis until it locks in place.
2. Determine where to mount the storage system in the rack and mark the location at the front and rear of the rack.

**NOTE:** The storage system and expansion enclosures each require 2U of rack space for installation.

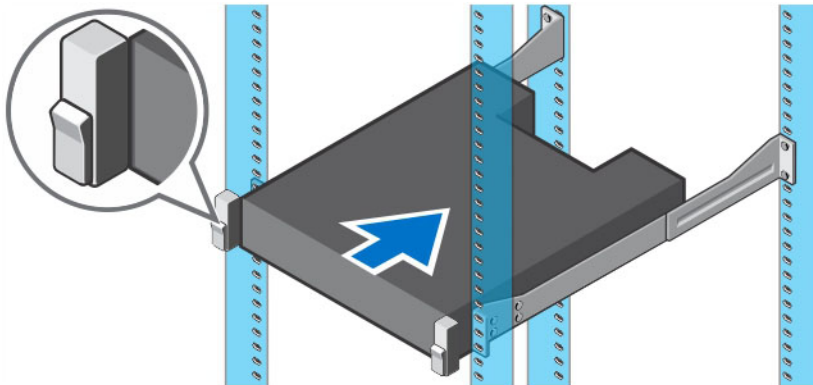
3. Position the rails at the marked locations and extend the rails to fit the rack.
4. Insert the top rail pin in the middle hole of the top 1U and insert the bottom rail pin in bottom hole of the bottom 1U.
5. Insert a screw into the top hole of the bottom 1U and tighten the screw to secure the rail to the rack.





**Figure 2. Hole Locations in Rack**

1. Middle hole of top 1U
  2. Top hole of bottom 1U
  3. Bottom hole of bottom 1U
6. Slide the storage system chassis onto the rails.



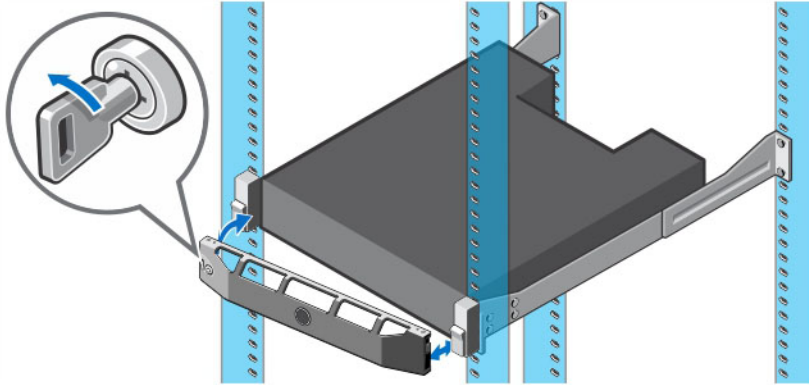
**Figure 3. Mount the SCv2000/SCv2020 Storage System Chassis**

7. Secure the storage system chassis to the rack using the mounting screws within each chassis ear.
  - a. Lift the latch on each chassis ear to access the screws.
  - b. Tighten the screws to secure the chassis into the rack.
  - c. Close the latch on each chassis ear.
8. If the Storage Center system includes expansion enclosures, mount the expansion enclosures in the rack. See the instructions included with the expansion enclosure for detailed steps.

## Installing the Front Bezel

Install the bezel on the front of the storage system.

1. Hook the right end of the bezel onto the storage system.



**Figure 4. Front Bezel**

2. Insert the left end of the bezel into the securing slot until the release latch snaps into place.
3. Secure the bezel with the keylock.

## Front-End Cabling

Front-end cabling refers to the connections between the storage system and host servers. Front-end connections can be made using Fibre Channel, iSCSI, or SAS interfaces.

The storage system connects to switches or connects directly to a host server, depending on the type of front-end ports.

- A storage system with Fibre Channel front-end ports connects to one or more FC switches, which connect to one or more host servers.
- A storage system with iSCSI front-end ports connects to one or more Ethernet switches, which connect to one or more host servers.
- A storage system with a SAS front-end interface connects directly to one or more host servers.

In addition, the MGMT port on each storage controller connects to an Ethernet switch on the management network. This connection to the management network allows configuration, administration, and management of the Storage Center.

For more information, see the *Dell Storage Center SCv2000/SCv2020 Storage System Deployment Guide*.

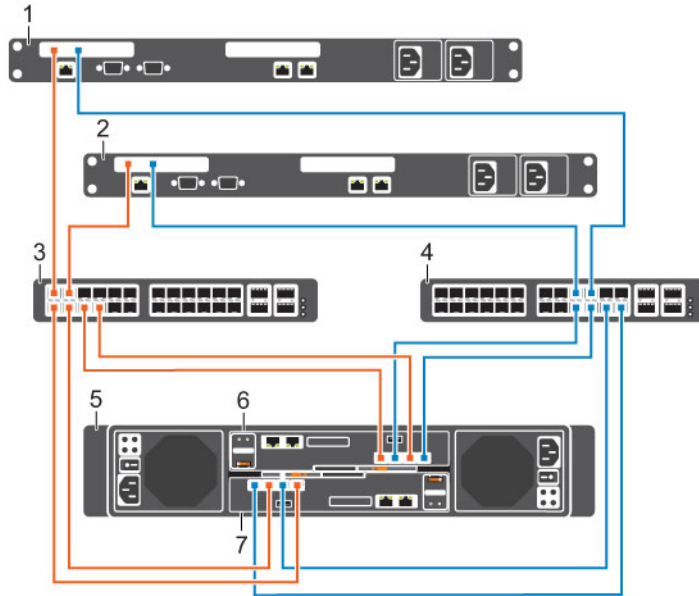
## Cabling SAN-Attached Host Servers

An SCv2000/SCv2020 storage system with Fibre Channel or iSCSI front-end ports connects to host servers through Fibre Channel or Ethernet switches.

**NOTE:** The top storage controller is storage controller 1 and the front-end ports are numbered left to right. The bottom storage controller is storage controller 2 and the front-end ports are numbered right to left.

1. Connect each host server to the switches.
2. Connect fault domain 1 to switch 1.
  - a. Connect a cable from storage controller 1: port 1 to switch 1.
  - b. Connect a cable from storage controller 2: port 1 to switch 1.
  - c. (Four port I/O card only) Connect a cable from storage controller 1: port 3 to switch 1.
  - d. (Four port I/O card only) Connect a cable from storage controller 2: port 3 to switch 1.

3. Connect fault domain 2 to switch 2.
  - a. Connect a cable from storage controller 1: port 2 to switch 2.
  - b. Connect a cable from storage controller 2: port 2 to switch 2.
  - c. (Four-port I/O card only) Connect a cable from storage controller 1: port 4 to switch 2.
  - d. (Four-port I/O card only) Connect a cable from storage controller 2: port 4 to switch 2.



**Figure 5. Storage System Connected to Switches and Host Servers**

- |                                   |                         |
|-----------------------------------|-------------------------|
| 1. Server 1                       | 2. Server 2             |
| 3. Switch 1                       | 4. Switch 2             |
| 5. SCv2000/SCv2020 storage system | 6. Storage controller 1 |
| 7. Storage controller 2           |                         |

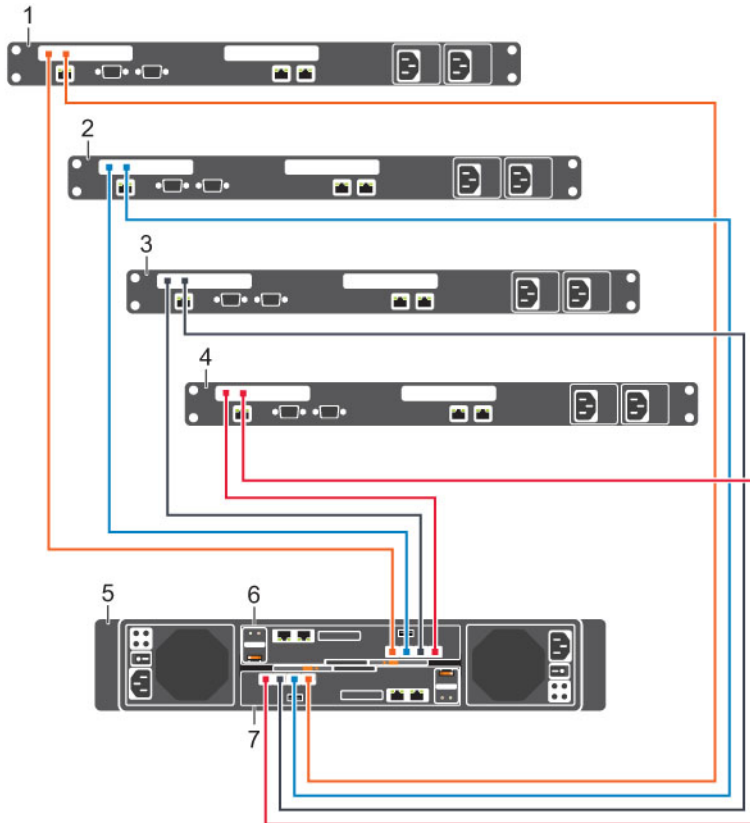
### Cabling Direct-Attached Host Servers

An SCv2000/SCv2020 storage system with SAS front-end ports connects directly to host servers.

**NOTE:** The top storage controller is storage controller 1 and the front-end ports are numbered left to right. The bottom storage controller is storage controller 2 and the front-end ports are numbered right to left.

1. Connect fault domain 1 to host server 1.
  - a. Connect a SAS cable from storage controller 1: port 1 to server 1.
  - b. Connect a SAS cable from storage controller 2: port 1 to server 1.
2. Connect fault domain 2 to host server 2.
  - a. Connect a SAS cable from storage controller 1: port 2 to server 2.
  - b. Connect a SAS cable from storage controller 2: port 2 to server 2.
3. Connect fault domain 3 to host server 3.
  - a. Connect a SAS cable from storage controller 1: port 3 to server 3.
  - b. Connect a SAS cable from storage controller 2: port 3 to server 3.
4. Connect fault domain 4 to host server 4.

- a. Connect a SAS cable from storage controller 1: port 4 to server 4.
- b. Connect a SAS cable from storage controller 2: port 4 to server 4.



**Figure 6. Storage System Connected Directly to Host Servers**

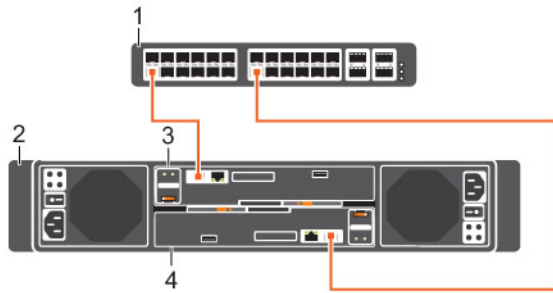
- |                                   |                         |
|-----------------------------------|-------------------------|
| 1. Server 1                       | 2. Server 2             |
| 3. Server 3                       | 4. Server 4             |
| 5. SCv2000/SCv2020 storage system | 6. Storage controller 1 |
| 7. Storage controller 2           |                         |

### Cabling the Ethernet Management Network

The Ethernet management (MGMT) interface of each storage controller must be connected to a management network.

**NOTE:** The top storage controller is storage controller 1 and the bottom storage controller is storage controller 2.

1. Connect an Ethernet cable from the MGMT port on storage controller 1 to the management network switch.
2. Connect an Ethernet cable from the MGMT port on storage controller 2 to the management network switch.



**Figure 7. Storage System Connected to a Management Network**

- |                              |                                   |
|------------------------------|-----------------------------------|
| 1. Management network switch | 2. SCv2000/SCv2020 storage system |
| 3. Storage controller 1      | 4. Storage controller 2           |

## Back-End Cabling

An SCv2000/SCv2020 storage system can be deployed with or without SC100/SC120 expansion enclosures.

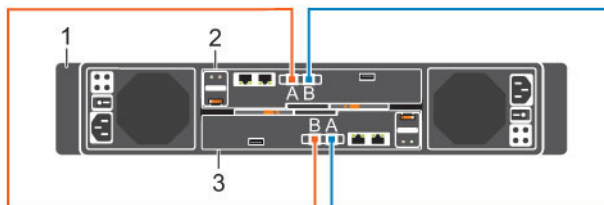
If the storage system is installed without expansion enclosures, you must interconnect the two storage controllers together.

### Interconnecting Two Storage Controllers

When an SCv2000/SCv2020 with two storage controllers is deployed without expansion enclosures, the storage controllers must be interconnected using SAS cables.

**NOTE:** The top storage controller is storage controller 1 and the bottom storage controller is storage controller 2.

1. Connect a SAS cable between storage controller 1: port A and storage controller 2: port B.
2. Connect a SAS cable between storage controller 1: port B and storage controller 2: port A.



**Figure 8. Interconnected Storage Controllers**

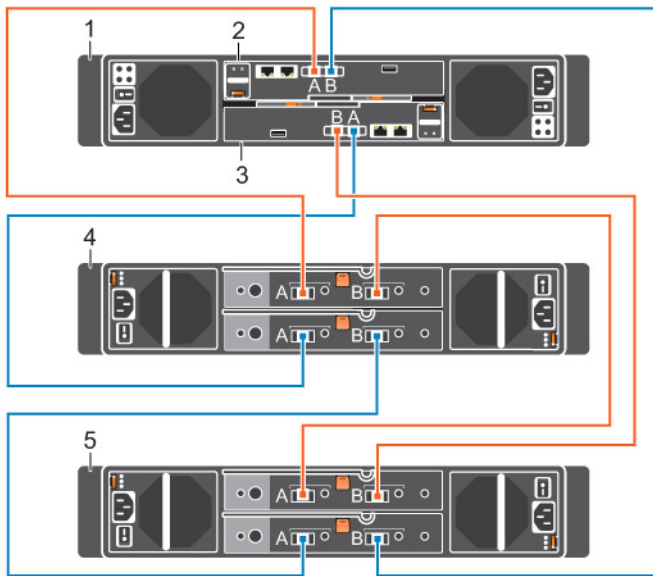
- |                                   |                         |
|-----------------------------------|-------------------------|
| 1. SCv2000/SCv2020 storage system | 2. Storage controller 1 |
| 3. Storage controller 2           |                         |

### Cabling an Expansion Enclosure to a Storage System

An SCv2000/SCv2020 storage system supports multiple SC100/SC120 expansion enclosures. Use SAS cables to connect an SC100/SC120 expansion enclosure to an SCv2000/SCv2020 storage system.

**NOTE:** In an SCv2000/SCv2020 storage system, the top storage controller is storage controller 1 and the bottom storage controller is storage controller 2.

1. If you are installing more than one expansion enclosure, cable the expansion enclosures in series by connecting a SAS cable from the top EMM, port B of one expansion enclosure to the top EMM, port A of the next expansion enclosure. Continue cabling the expansion enclosures in series until all of the expansion enclosures are connected together.
2. Connect a SAS cable from storage controller 1: port A to the first expansion enclosure in the SAS chain: top EMM, port A.
3. Connect a SAS cable from storage controller 2: port B to the last expansion enclosure in the SAS chain: top EMM, port B.
4. Connect a SAS cable from storage controller 1: port B to the last expansion enclosure in the SAS chain: bottom EMM, port B.
5. Connect a SAS cable from storage controller 2: port A to the first expansion enclosure in the SAS chain: bottom EMM, port A.



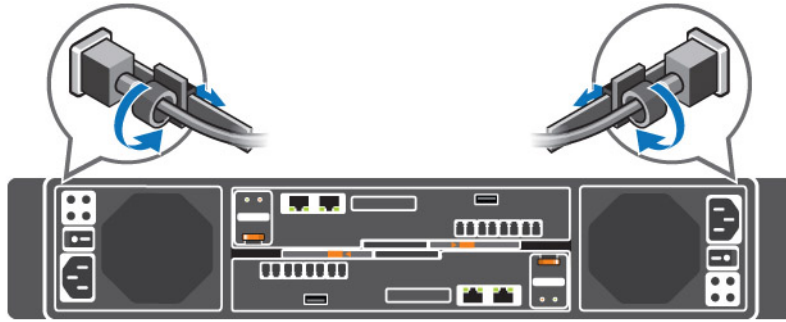
**Figure 9. Cabling an SC100/SC120 Expansion Enclosure to an SCv2000/SCv2020 Storage System**

- |                                   |                          |
|-----------------------------------|--------------------------|
| 1. SCv2000/SCv2020 storage system | 2. Storage controller 1  |
| 3. Storage controller 2           | 4. Expansion enclosure 1 |
| 5. Expansion enclosure 2          |                          |

## Connecting the Power Cables

Connect power cables to the storage system.

1. Make sure that the power switches on the storage system are in the OFF position before connecting the power cables.
2. Connect the power cables to the power supplies in the storage system chassis.



**Figure 10. Power Cables**

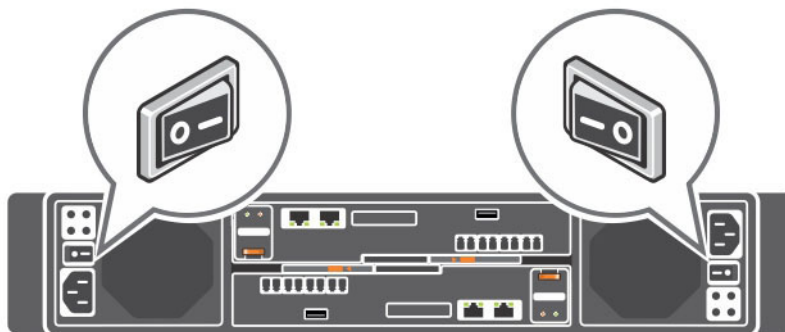
3. Secure each power cable to the storage system chassis using the strain relief fasteners.
4. Plug the other end of the power cables into a grounded electrical outlet or a separate power source such as an uninterruptible power supply (UPS) or a power distribution unit (PDU).

## Turning on the Storage System

Turn on the storage system after racking and cabling all of the Storage Center components.

Turn on the Storage Center system components in the following order:

1. Turn on the network switches (if installed).
2. Turn on the expansion enclosures (if installed).
  - ✎ **NOTE:** Before turning on the storage system, make sure that the status indicator on the front of each expansion enclosure is blue.
3. Turn on the storage system by pressing both power switches at the same time.




**Figure 11. Location of the SCv2000/SCv2020 Storage System Power Switches**

- ✎ **NOTE:** Before turning on the host servers, make sure that the status indicator on the front of the storage system is blue.
4. Turn on the host servers that are connected to the storage system.


## Installing and Using the Dell Storage Client

The Dell Storage Client configures, manages, and monitors an SCv2000/SCv2020 storage system.

1. Go to [support.dell.com](http://support.dell.com) and download the Dell Enterprise Manager software.
2. Install the Enterprise Manager Client on a host server.

 **NOTE:** To discover and configure a Storage Center, the software must be installed on a host server that is located on the same subnet as the storage system

3. Start the software by double-clicking the Enterprise Manager Client shortcut. The Dell Storage Client welcome screen appears.
  - To discover and configure an uninitialized SCv2000/SCv2020 storage system, click the **Discover and Configure Uninitialized SCv2000 Series Storage Centers** link and follow the steps in the wizard.
  - To connect to an initialized SCv2000/SCv2020 storage system, click the **Log in to a Storage Center or Data Collector** link.
  - To set up the host server to access Storage Center and configure Best Practices for performing IO, click the **Setup this host to access a Storage Center** link and follow the steps in the wizard.

 **NOTE:** For more information about installing the Dell Storage Client, configuring a storage system, and performing post-installation tasks, see the *Dell Storage Center SCv2000/SCv2020 Storage System Deployment Guide*.

## NOM Information (Mexico Only)

The following information is provided on the device described in this document in compliance with the requirements of the official Mexican standards (NOM):

Importer:	Dell Inc. de México, S.A. de C.V Paseo de la Reforma 2620-11 ° Piso Col. Lomas Atlas 11950 México, D.F.
Model number:	E09J and E10J
Supply voltage:	100–240 VAC
Frequency:	50/60 Hz
Current consumption:	7.6–3.0 A

## Technical Specifications

The technical specifications of the SCv2000/SCv2020 storage systems are displayed in the following tables.

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<b>Drives</b>	
SAS hard drives	<b>SCv2000:</b> Up to 12 3.5-inch SAS hot-swappable hard drives (6.0 Gbps) <b>SCv2020:</b> Up to 24 2.5-inch SAS hot-swappable hard drives (6.0 Gbps)

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<b>Storage Controllers</b>	
Storage controllers	Up to two hot-swappable storage controllers with the following IO options: <ul style="list-style-type: none"><li>• Two 16 Gbps Fibre Channel ports</li><li>• Four 8 Gbps Fibre Channel ports</li><li>• Two 10 Gbps iSCSI ports</li><li>• Four 1 Gbps iSCSI ports</li><li>• Four 12 Gbps SAS ports</li></ul>



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## Storage Connectivity

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Configurations	Storage Center supports up to 168 drives in one redundant-path SAS chain <ul style="list-style-type: none"><li>• An SCv2000 supports up to 13 SC100 expansion enclosures or 6 SC120 expansion enclosures</li><li>• An SCv2020 supports up to 12 SC100 expansion enclosures or 6 SC120 expansion enclosures</li></ul>
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## Redundant Array of Independent Disks (RAID)



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Controller	Two hot-swappable storage controllers
Management	RAID management using Dell Storage Client 2015 R1

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## Back-Panel Ports Connectors (per Storage Controller)

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Fibre Channel, iSCSI, or SAS connectors	Connection to a Fiber Channel fabric, iSCSI network, or a direct connection to servers with SAS HBAs
Ethernet connectors	<b>MGMT:</b> 10 Mbps, 100 Mbps, or 1 Gbps embedded Ethernet port used for Storage Center management <b>REPL:</b> 10 Mbps, 100 Mbps, or 1 Gbps embedded iSCSI port used for replication to another Storage Center
SAS connectors	6 Gbps SAS connectors for SAS port redundancy and additional expansion enclosures  <b>NOTE:</b> SAS connectors are SFF-8086/SFF-8088 compliant
USB connector	One USB 3.0 connector used for Storage Center updates
Serial connector	 <b>NOTE:</b> Not for customer use

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## LED Indicators

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Front panel	<ul style="list-style-type: none"><li>• One two-color LED indicator for system status.</li><li>• One single-color LED indicator for power status.</li><li>• Two digit, seven-segment display indicating the storage system ID number</li><li>• ID button with a single-color LED indicating startup and pressed states</li></ul>
Hard drive carrier	<ul style="list-style-type: none"><li>• One single-color activity LED</li><li>• One single-color LED status indicator per drive</li></ul>
Storage controller	<ul style="list-style-type: none"><li>• Two single-color LEDs per Ethernet port indicating activity and link speed</li><li>• Four dual-color LEDs per SAS connector indicating port activity and status</li><li>• One single-color LED indicating status</li><li>• One single-color LED indicating fault</li><li>• One single-color LED for identification</li><li>• Eight single-color LED for diagnostics</li></ul>
Power supply/cooling fan	Four LED status indicators for Power Supply Status, AC Fail status, DC Fail status, and Fan Fail status

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**Power Supplies**

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AC power supply (per power supply)

Wattage	580 W (maximum wattage: 584 W)
Voltage	100–240 VAC (7.6–3.0 A)
Heat dissipation	<b>SCv2000:</b> 65 W at 230 VAC and 99 W at 115 VAC <b>SCv2020:</b> 65 W at 230 VAC and 99 W at 115 VAC

Maximum inrush current Under typical line conditions and over the entire system ambient operating range, the inrush current may reach 45 A per power supply for 40 ms or less

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**Available Hard Drive Power (Per Slot)**

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Supported hard drive power consumption (continuous)	Up to 1.2 A at +5 V Up to 0.5 A at +12 V
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**Physical**

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Height	8.79 cm (3.46 in.)
Width	48.2 cm (18.98 in.)
Depth	<b>SCv2000:</b> 54.68 cm (21.53 in.) <b>SCv2020:</b> 54.68 cm (21.53 in.)
Weight (maximum configuration)	<b>SCv2000:</b> 29 kg (64 lb) <b>SCv2020:</b> 24 kg (53 lb)
Weight without drives	<b>SCv2000:</b> 21 kg (46 lb) <b>SCv2020:</b> 19 kg (41 lb)

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**Environmental**

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For additional information about environmental measurements for specific storage system configurations, see [dell.com/environmental\\_datasheets](http://dell.com/environmental_datasheets).

**Temperature**

Operating	5° to 57°C (41° to 135°F) with a maximum temperature gradation of 10°C per hour 52°C (126°F) maximum 2,000 to 3,048 m (6,562 to 10,000 ft) 47°C (117°F) maximum 3,048 to 4,000 m (10,000 to 13,123 ft)
Storage	–40° to 65°C (–40° to 149°F) at a maximum altitude of 12,000 m (39,370 ft)

**Relative humidity**

Operating	10% to 80% (noncondensing) with 29°C (84.2°F) maximum dew point
Storage	5% to 95% (noncondensing) with 33°C (91°F) maximum dew point

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**Environmental**

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**Maximum vibration**

Operating 0.21 G at 5–500 Hz for 15 min

Storage 1.04 G at 2–200 Hz for 15 min

**Maximum shock**

Operating Half-sine shock 5 G +/- 5% with a pulse duration of 10 ms +/- 10% (in operational orientations only)

Storage Half-sine shock 30 G +/- 5% with a pulse duration of 10 ms +/- 10% (all sides)

**Altitude**

Operating 0 to 3,048 m (0 to 10,000 ft)  
For altitudes above 915 m (3,000 ft), the maximum operating temperature is derated 1°C per 300 m (1°F per 547 ft)

Storage –300 to 12,192 m (–1000 to 40,000 ft)

**Airborne Contaminant Level**

Class G1 or lower as defined by ISA-S71.04-1985